Stem cell quiescence acts as a tumour suppressor in squamous tumours.

Journal: Nat Cell Biol

Publication Year: 2013

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PubMed link: 24335650

Funding Grants: UCLA CIRM Research Training Program II

Public Summary:
Hair follicle stem cells, the tissue-specific adult stem cells that generate hair follicles, are also the cells of origin for cutaneous squamous cell carcinoma, a common skin cancer. Hair follicle stem cells cycle between periods of activation, during which they can grow, and quiescence, when they remain dormant. Using mouse models, we applied known cancer-causing genes to hair follicle stem cells, and found that during cell quiescence, hair follicle stem cells could not initiate squamous cell carcinoma. Once the hair follicle stem cells were in their active period, cancer growth began. Furthermore, we found that Pten, a gene important in regulating the cell's response to signaling pathways, mediated tumor suppression via adult stem cell quiescence. Understanding cancer suppression through quiescence could better inform preventative strategies in patients susceptible to squamous cell carcinoma. This study also may reveal parallels between squamous cell carcinoma and other cancers in which stem cells have a quiescent phase.

Scientific Abstract:
In some organs, adult stem cells are uniquely poised to serve as cancer cells of origin. It is unclear, however, whether tumorigenesis is influenced by the activation state of the adult stem cell. Hair follicle stem cells (HFSCs) act as cancer cells of origin for cutaneous squamous cell carcinoma and undergo defined cycles of quiescence and activation. The data presented here show that HFSCs are unable to initiate tumours during the quiescent phase of the hair cycle, indicating that the mechanisms that keep HFSCs dormant are dominant over the gain of oncogenes (such as Ras) or the loss of tumour suppressors (such as p53). Furthermore, Pten activity is necessary for quiescence-based tumour suppression, as its deletion alleviates tumour suppression without affecting proliferation. These data demonstrate that stem cell quiescence is a form of tumour suppression in HFSCs, and that Pten plays a role in maintaining quiescence in the presence of tumorigenic stimuli.